An effect of support price toward the growth rate of sugarcane production: Evidence from Sindh and Punjab provinces of Pakistan

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This paper focuses on an effect of support price toward the growth rate of Sugarcane production: Evidence from Sindh and Punjab provinces of Pakistan by using secondary time series data from the period of 1990-91 to 2013-14. Growth rate model and Cobb-Douglas production function was applied to analyze the data. Every year government of Pakistan announced support price for sugarcane crop, the aimed of announcing supporting price to save the sugarcane producers for achieving the target of sugar production. In Punjab province, since 1990-91 to 2013-14 total growth rate of sugarcane in area, production and yield were increased 2.24%, 4.67% and 2.33% respectively. However, in Sindh Province total growth rate was calculated 1.42% for area, 3.35 for production and 1.78% for yield respectively. The results of regression analysis indicate that the both province’s area and support price have significant relationship with production. However its necessary to increase support price if the support price increase than the farmers take keen interest for cultivating more area under sugarcane with use of modern technologies and also increase the applications of inputs, so that the government of Pakistan should increase support price for promoting the sugarcane production both Sindh and Punjab provinces of Pakistan.

Key words: Sugarcane production, support price, growth rate, cobb-Douglas, Sindh and Punjab, Pakistan

INTRODUCTION

Agriculture play a vital role in Pakistan`s economy. This sector provides raw material to agro based industries. The most significant role of agriculture in the economy of Pakistan is to surpluses generate for export to earn foreign exchange. In 2015 its account 20.9 percent in the grass domestic product (GDP) and 43.5% is the source of earning for rural peoples, furthermore agriculture effective supporting sustainable sophisticated economic growth and also a significant impact on reducing of poverty in Pakistan. Agriculture sector has traditionally sustained a satisfactory growth to ensure food security for rapidly growth of population. Yet, the main challenges faced the farmer’s low returns of agricultural commodities due to high cost of production. (GOP 2014-15)

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Sugarcane is the most important cash crop of Pakistan. Sugarcane mostly cultivated for producing sugar, and correlated products, such as Gur, sugar used for human diet, fuel and fiber has been advocated through by products (Deepchand 1986). About 99 percent of sugar extracted from sugarcane in Pakistan for demand at national level (Azam and Mukarram 2010). Sugarcane also have significant relationship with Board industries for making papers. Sugarcane account 3.1% in value addition and 0.6% share in GDP. (GoP 2014-15) sugarcane was cultivated on area of 1141 thousand hectares in the year of 2014-15 it is decreasing 2.6% beside preceding year of 2013-14 the area was cultivated 1173 thousand hectares. The production of sugarcane was recorded 62.7 million tons in 2014-15 it was 7.1% less than last year 2014-15. The factor affection reducing of crop production due to decreasing Area, heavy rainfall flood, climate changes the main effect of reducing production due to announced unwanted policies about supporting price of sugarcane crop.

In Pakistan sugarcane generally cultivated in three provinces Sindh, Punjab and NWFP (Masood and Javed 2004). The highest production of sugarcane was recorded in Punjab 37,704, thousand tons in 2013-14, in Sindh 18,362, thousand tons and NWFP, 5,361, thousand tons, Sindh and NWFP received lower production as compare to Punjab but the yield of Sugarcane/hac highest was recorded in Sindh 61.71 tons/hac, Punjab 57.75 tons/hac and NWFP received lower 45.68 tons/hac.

In Pakistan sugarcane industries is second largest agro based industry after textile industries, its account 3.25 in value addition and 0.6% in GDP (LCCI 2013). There are total 88 Sugar mills, 44 sugar mills in Punjab, 36 in Sindh and 08 in NWFP, rapidly growth of sugar industries also contribute in the growth of economy of Pakistan, sugarcane is one of the biggest revenue source of Pakistan’s government, due to sugarcane fetches billion of rupees in the farm of duties and taxes to government (Adnan Nazir 2013), its employee 1.5 million workers, including; financial experts, management experts, technologist (engineers), skilled, semiskilled and unskilled workers working in sugar industries of Pakistan (LCCI).

The contribution of sugarcane in GDP, employment, foreign earning and rising the income of farmers, however the government of Pakistan announced supporting price of sugarcane to support the farmers for cultivating more area and to use modern technologies with maximum inputs for the achieving of government targets, (Magsi 2012) The main cause of conducting this study was to compare the effect of supporting price on growth rate of sugarcane production in (Sindh and Punjab) Pakistan.

**METHODOLOGY**

The Study entitled an effect of support price towards the growth rate of sugarcane production: Evidence from Sindh and Punjab provinces of Pakistan, was conduct for 24 years on the basis of secondary time series data, since the period of 1990-91 to 2013-14. The data were collected from Pakistan Sugar mills Association. The data were collected regarding area, production, Yield and supporting price which announced by Pakistani government. Both the micro and macro data were analyzed through use of Excel and SPSS software. Growth rate model and Cobb-Douglas production function were used for the finding of how much growth in sugarcane with time index? Which independents variable impact on sugarcane production? And how supporting price effecting on sugarcane production?

**Growth rate Model:** secondary time series data were analyzed sugarcane production, area and yield for the estimation of growth rate.

\[
g_t = \frac{X_T - X_0}{X_T}
\]

\(g_t = \text{growth rate} \)
\(X_T = \text{1st year value of variable } X \)
\(X_0 = \text{2nd year value of variable } X \)
\(T = \text{1st year} \)
\(0 = \text{next year} \)

Cobb-Douglas production function was specified as under:

\[
Y = f (X_1^{\beta_1} X_2^{\beta_2})
\]

\[
\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2
\]

\(\ln \beta_0 = \text{Natural logarithm of sugarcane in (000) tones.} \)
\(\ln X_1 = \text{Natural logarithm of sugarcane cropped area in (000) cultivated hectares} \)
\(\ln X_2 = \text{Natural logarithm of sugarcane crop supporting Price/40kg.} \)
\(\mu = \text{error term} \)

**RESULTS AND DISCUSSION**

This study presents growth of sugarcane production, area and yield in Sindh and Punjab provinces, and to estimating relationship of area and support price with production of sugarcane in Sindh and Punjab provinces of Pakistan.

Figure 1, 2 and 3 represents sugarcane production area and yield difference in both provinces of Pakistan, Figure No 1 and 2 indicate that the area and production growth with time index in Punjab and Sindh provinces of Pakistan in Punjab are higher than Sindh Province, the higher area under sugarcane cultivation recorded in 2007-08, 872.2 thousand hectares and production was 40,306.0 thousand tons but in 2008-09 the area of sugarcane was cultivated 666.5 thousand hectares.
and production was 32,294.7 thousand tons. The area was decrease, 23.5% and the production was decrease 19.8% less then area. Since 2008-9 to 2013-14 the area of Punjab sugarcane cultivation increase 13.5% and the production was increased 35.3 % it is double than area. In case of Sindh province the area of sugarcane was cultivated more 308.8 thousand hectares in 2007-08 in same year more production received by growers 18,793.9 thousand tons but the area and production of sugarcane in Sindh province also decreased in 2008-09 till to 263.9 thousand hectares and production was decreased 13,304.3 thousand tones. The decreasing ratio of area in 2008-09 was 14.5% and 29.2% production decrease more than area, since 2008-09 to 2013-14 area was increased 12.7% and the production was increase 38% it is 3re times more than area, and the figure 3 Indicate that the difference of sugarcane yield in Sindh and Punjab provinces with time index. In Sindh province yield of sugarcane always be more than Punjab province the highest yield was recorded in Sindh province 1574 mnds/hac in 1998-99 in same time period the yield of sugarcane was recorded in Punjab province 1171.5 mnds/hectare, the growth of yield in both province from 1998-99 to 2014-14, in Sindh province decrease 1% but the growth rate of yield in Punjab increasing 23% in same time period, in 2013-14 the yield of sugarcane in Sindh was recorded 1542.75 mnds/hac and in Punjab was recorded, 1443.75 mnds/hac, it means from 1998-99 to 2013-14 the growers of Sindh province stable same yield no big difference and Punjab province growers keep to
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Figure 3. Sugarcane Yield hectare$^{-1}$ with time index both Sindh and Punjab provinces of Pakistan

Table 1. Growth rate of sugarcane production, area and yield in Sindh and Punjab province of Pakistan, since 1990-91 to 2013-14

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (%)</th>
<th>Production (%)</th>
<th>Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Punjab</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990-91 to 1994-95</td>
<td>3.13</td>
<td>7.04</td>
<td>3.61</td>
</tr>
<tr>
<td>1995-96 to 2000-01</td>
<td>1.92</td>
<td>4.63</td>
<td>2.31</td>
</tr>
<tr>
<td>2001-02 to 2006-07</td>
<td>5.44</td>
<td>4.84</td>
<td>0.48</td>
</tr>
<tr>
<td>2007-08 to 2013-14</td>
<td>-1.52</td>
<td>2.18</td>
<td>2.92</td>
</tr>
<tr>
<td><strong>Average growth 24 years</strong></td>
<td><strong>2.24</strong></td>
<td><strong>4.67</strong></td>
<td><strong>2.33</strong></td>
</tr>
<tr>
<td><strong>Sindh</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990-91 to 1994-95</td>
<td>0.21</td>
<td>2.31</td>
<td>2.00</td>
</tr>
<tr>
<td>1995-96 to 2000-01</td>
<td>-0.66</td>
<td>-1.78</td>
<td>-1.58</td>
</tr>
<tr>
<td>2001-02 to 2006-07</td>
<td>6.13</td>
<td>12.07</td>
<td>5.96</td>
</tr>
<tr>
<td>2007-08 to 2013-14</td>
<td>0.01</td>
<td>0.78</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>Average growth 24 years</strong></td>
<td><strong>1.42</strong></td>
<td><strong>3.35</strong></td>
<td><strong>1.78</strong></td>
</tr>
</tbody>
</table>

Data Source: Author’s calculation with use of Excel (2016)

Table 2. Summary statistics of relationship between area and support price with production in Sindh and Punjab province of Pakistan

<table>
<thead>
<tr>
<th>Independent</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-test</th>
<th>Significant level</th>
<th>R²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Punjab</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>1.189</td>
<td>0.335</td>
<td>3.553</td>
<td>0.002</td>
<td>0.97</td>
<td>175.68</td>
</tr>
<tr>
<td>Ln X₁</td>
<td>1.074</td>
<td>0.127</td>
<td>8.491</td>
<td>0.000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ln X₂</td>
<td>0.159</td>
<td>0.022</td>
<td>7.212</td>
<td>0.000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Sindh</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>1.223</td>
<td>0.423</td>
<td>2.890</td>
<td>0.009</td>
<td>0.70</td>
<td>24.452</td>
</tr>
<tr>
<td>Ln X₁</td>
<td>1.184</td>
<td>0.175</td>
<td>6.750</td>
<td>0.057</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ln X₂</td>
<td>0.050</td>
<td>0.025</td>
<td>2.013</td>
<td>0.000</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Data Source: Author’s calculation with use of SPSS.

rising the yield, the variation of production and area, shortage of irrigation, climate changes, heavy flood, heavy rain, due to rain and flood insecticide and pesticide attack increased and the main factor of fluctuation production and area is marketing price of sugarcane Both Sindh and Punjab provinces of Pakistan. Further analyze to growth rate of area, production with time index of sugarcane crop in Sindh and Punjab
province of Pakistan. However, we tested average growth rate model for production, area and yield of sugarcane through the use of secondary time series data of sugarcane crop.

Table1 indicate that the growth rate of sugarcane production, area and yield in Sindh and Punjab province of Pakistan, results shows that in Punjab from 1990-91 to 1994-95 area, production and yield growth was increase 3.13%, 7.04% and 3.61 percent it was more than Sindh province was calculated 0.21% 2.31% and 2.00% respectively. In case of 1995-96 to 2000-01 was intended again more than Sindh province, in Punjab growth rate was, 1.92%, 4.63% and 2.31% but in this time period Sindh province area not increase but its goes minus -0.66%, production and yield also decrease -1.78% and -1.58%, it means in Sindh province have significant relationship between area, production and yield, if area fallen production and yield also fallen. Nevertheless in 2001-01 to 2006-07 the growth of area, production and yield of Sindh province increased much more than Punjab which was calculated 6.13%, 12.07% and 5.96%, in the same time period Punjab growth rate increased 5.44%, 4.84% and 0.84% respectively. In case of 2007-08 to 2013-14 in Sindh province growth rate of area, production and yield increased little 0.01%, 0.78% and 0.73% as compare to Sindh the growth rate of area in Punjab province decrease till -1.52% nevertheless the production and yield increased 2.18% and 2.92% it means in Punjab province have no big significant relationship between area yield and production. The overall average growth rate of sugarcane production, area and yield during 24Year since1990-91 to 2013-14 in Punjab growth rate increased more 2.24% of area, 4.67% production and yield 2.33%, as compare to Punjab province in Sindh province growth rate increased lower which was calculated 1.42% for area, 3.35 for production and 1.78% for Yield respectively.

Furthermore, the results of regression analysis which are presents in table2. As the cobb-Douglas production function was used, however the estimated co-efficient of the elasticity of the production, in case of Punjab the co-efficient of intercept is 1.189 representing the natural log of expected production of sugarcane when there is no impact of support price, the co-efficient of area (ln X_1) is 1.074 if the area of sugarcane increase 1 percent the production of sugarcane will increase 1.074 percent, and the co-efficient of support price (Ln X_2) also have significant which is 0.159, it measures if the support price increase one percent the production of sugarcane will increase 0.159%, in Punjab province both area and support price have significant relationship with production, the significant level is 0.1% percent, the value of R-square 0.97 which indicate that it’s about 97% of total change in production of sugarcane crop, and the value of F-calculated is 175.68 which indicate that its highly significant relationship between area and support price with production of sugarcane crop in Punjab, as compare to Punjab province the impact of supporting price and area on sugarcane production in Sindh province indicate that the coefficient of the elasticity of the production which is 1.223 indicate that the natural log of expected production of sugarcane when there is no significant impact of area and support price, after that the coefficient of area is 1.184 which indicate closely relationship with production, if the area increase 1 percent than the production will increased 1.184%, and the co-efficient of support price also have significant relationship but not highly level which is 0.050 it means if the support price increased 1percent thus the production of sugarcane will increase 0.050% in Sindh province, the significant level is 0.5% therefore the value of R-Square is 0.70 it means the possibility 70% total change of sugarcane production and the value of F-calculate is 24.452 it shows relationship of area and support price with sugarcane production in Sindh, but it is the lower than Punjab. due to water shortages, a lack of high yielding varieties and Mills are typically bound to pay, so the farmers do not willing to cultivate more area and use of more inputs. Therefore, it is necessity to support price increase if the support price increase than the farmers take keen interest for cultivating more area under sugarcane with use of modern technologies and also increase the applications of inputs, however the government of Pakistan should increase support price for promoting the sugarcane production both Sindh and Punjab province of Pakistan (Alam 2007)

**CONCLUSION AND RECOMMENDATIONS**

This study was conduct on the basis of secondary time series data since 1990-91 to 2013-14 for comparing the effect of support price to growth rate of sugarcane production in Sindh and Punjab province of Pakistan through the use of growth rate model and cobb-Douglas model. The results indicate that in Punjab growth rate of area, production and yield increased more 2.24% of area, 4.67% production and yield 2.33%, as compare to Punjab province in Sindh province growth rate increased lower which was calculated 1.42% for area, 3.35 for production and 1.78% for Yield respectively. However the relationship of area and support price with production have significant results shows, in case of Punjab the co-efficient of intercept is 1.189 representing the natural log of expected production of sugarcane when there is no impact of support price, the co-efficient of area (ln X_1) is 1.074 if the area of sugarcane increase 1 percent the production of sugarcane will increase 1.074 percent, and the co-efficient of support price (Ln X_2) also have significant which is 0.159, it measures if the support price increase one percent the production of sugarcane will increase 0.159%, in Punjab province both
area and support price have significant relationship with production, the significant level is 0.1\% percent, the value of R-square 0.97 which indicate that it’s about 97\% of total change in production of sugarcane crop, and the value of F-calculated is 175.68 which indicate that its highly significant relationship between area and support price with production of sugarcane crop in Punjab, as compare to Punjab province the impact of supporting price and area on sugarcane production in Sindh province indicate that the coefficient of the elasticity of the production which is 1.223 indicate that the natural log of expected production of sugarcane when there is no significant impact of area and support price, after that the coefficient of area is 1.184 which indicate closely relationship with production, if the area increase 1 percent than the production will increased 1.184\%, and the co-efficient of support price also have significant relationship but not highly level which is 0.050 it means if the support price increased 1percent thus the production of sugarcane will increase 0.050\% in Sindh province, the significant level is 0.5\% therefore the value of R-Square is 0.70 it means the possibility 70\% total change of sugarcane production and the value of F-calculate is 24.452 it shows relationship of area and support price with sugarcane production in Sindh, yet it is the lower than Punjab. Both province results indicate that the production have significant relationship with area and support price its necessity to support price increase if the support price increase than the farmers take keen for cultivating more area under sugarcane with use of modern technologies and also increase the applications of inputs, however the government of Pakistan should increase support price for promoting the sugarcane production both Sindh and Punjab province of Pakistan. So that some policies recommendations for the improving of sugarcane production, in future it is important the research should be added as resource conversation with friendly environment objectives to ongoing agricultural research projects. New research should be provided to assist the farmers therefore they must be able to make better decision for practices management, the information about management should be provided through mass, electronic and paper media. Government should ensure the availability of new technologies with technical assistant, maintain canal irrigation system and also provide technically assistant to the controlling of pesticide and insecticide for rising production and supporting price also needed in both province Sindh and Punjab of Pakistan.

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